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A STUDY OF CERTAIN FACTORS AFFECTING CHILDRENS' SCHOOL PERFORMANCE.

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AS PART OF THE RESEARCH ON THE INFLUENCE OF RESPONSE-CONTINGENT REINFORCERS ON THE LEARNING AND PROBLEM-SOLVING BEHAVIOR OF CHILDREN, THE EFFECTS OF A LIMITED NUMBER OF VARIABLES ON THE PERFORMANCE OF CHILDREN OF THREE AGE LEVELS (4-5, 7-8, AND 10-11), SELECTED EQUALLY FROM MIDDLE- AND LOWER-CLASS BACKGROUNDS, WERE INVESTIGATED. THE EXPERIMENTAL DESIGN, A 2-ALTERNATIVE DISCRIMINATION TASK, WAS ONE IN WHICH THE REINFORCING EVENTS PROVIDED THE SUBJECTS WITH THEIR ONLY SOURCE OF INFORMATION ABOUT THE CORRECTNESS OR INCORRECTNESS OF THEIR RESPONSES. THE EXPERIMENT USED SIX TREATMENT GROUPS. THESE USED TWO TYPES OF REINFORCERS IN EACH OF THREE REINFORCEMENT COMINBATIONS WHICH WERE REWARD ONLY, PUNISHMENT ONLY, AND REWARD OR PUNISHMENT. THE TWO REWARD-PUNISHMENT SETS WERE (1) "RIGHT" OR "WRONG" SPOKEN BY THE EXPERIMENTER AND (2) CANDY OR A LOUD, RAUCOUS SOUND. EACH SUBJECT HAD 15 LEARNING TRIALS. RESULTS INDICATED THAT (1) NO BROAD GENERALIZATIONS ABOUT EFFECTS OR REINFORCERS COULD BE MADE SINCE REINFORCERS INTERACT, NOT ONLY WITH SUBJECT VARIABLES, BUT WITH CHARACTERISTICS OF THE TASK, INSTRUCTIONS, AND OTHER SITUATIONAL VARIABLES TO DETERMINE PERFORMANCE, AND (2) BOTH MIDDLE-CLASS AND LOWER-CLASS CHILDREN PERFORMED BETTER FOR THE SYMBOLIC RATHER THAN THE MATERIAL REWARDS. (AL)

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A Study of Certain Factors Affecting Childrens' School Performance

Cooperative Research Project No. S-292

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I. Problem

The potent effects of positive and negative reinforcers ("reward" and "punishment") on behavior have long been recognized by those interested in the learning process and have been extensively investigated by those working in the laboratory and in the field. The scope of these investigations has varied from studies of the effects of praise and censure on broad patterns of behavior such as those which occur in the classroom or other real life situations to laboratory studies of learning and problem-solving in which more limited types of reinforcement conditions are used to signal the correctness or incorrectness of specific, circumscribed responses so that their effects on mastery of the task can be determined. The potential importance to education of the knowledge that has been gained from these laboratory studies is reflected in the active interest that has arisen in recent years in the development of "teaching machines" or programmed instructional devices, and of operant-conditioning techniques to train the mentally retarded or to aid the recovery of the mentally ill, both of these methods having been designed to take advantage of the known efficacy of immediate, response-contingent reinforcement in shaping behavior.

Despite the extensive research that has been conducted with both children and adults, there are large gaps in our empirical knowledge concerning the effects of response-contingent reinforcers on the performance of learning and

problem-solving tasks. It is becoming increasingly apparent that characteristics of the task, experimental procedures, and the subjects themselves must be taken into account if statements about the relative effectiveness of different reinforcement conditions are to be made. What appears to be required is a series of parametric studies so that the relevant variables can be isolated and the nature of the empirical laws involving them can be more precisely determined.

The present project was proposed as the first of a series of investigations concerning the influence of response-contingent reinforcers on the learning and problem-solving behavior of children. Its aims were to investigate the effects of a limited number of variables on performance using a specific type of task within a particular type of experimental situation.

The specific experimental design that was used in the present investigation is one in which the reinforcing events provide the subjects with their only source of information about the correctness or incorrectness of their responses, as opposed to methods in which the experimentally manipulated reinforcers supplement informational feedback given to all subjects (e.g., a green light following correct response) and whose presence are therefore not essential for mastery of the task.

Three basic reinforcement conditions were employed. In the first of these, an overt, positive reinforcer (reward) is

given after correct responses and in the second, an overt negative reinforcer (punishment) is given after incorrect responses. As will be discussed in the subsequent section, it is important to note that no overt outcome event followed incorrect responses in the former condition or followed correct responses in the latter. The two conditions will therefore be designated as Reward-blank and Punishment-blank respectively. In the third condition, overt reinforcers followed both correct and incorrect responses and will be designated as a Reward-Punishment combination. Within the general category of rewards and punishments, the effects of two sub-classes were investigated: verbal-social ("Right" and "Wrong" spoken by the experimenter) and nonverbal (candy and a loud, raucous sound). The subjects were selected to fall at three different age levels (4-5 years, 7-8 years, 10-11 years), and came equally from homes of lower and middle-class socio-economic status.

II. Related Literature

A number of studies in which the reinforcers provide the only information given to the subject about response correctness have employed the verbal reinforcers "Right" and "Wrong". Normal children as young as four years of age (e.g., Curry, 1960; Meyer & Seidman, 1960) as well as adults (e.g., Buss, Braden, Orgel, & Buss, 1956) have consistently been found to perform better on problem-solving tasks under a condition in which the experimenter says "Wrong" following incorrect responses (Punishment-blank) than under a condition in which the experimenter says "Right" following correct responses (Reward-blank). A similar result was reported by Penney and Lupton (1961) in a study in which children received a material reward (candy) for correct responses and a noxious stimulus for errors.

With respect to the effects of Reward-Punishment, a number of studies using both verbal reinforcers (e.g., Curry, 1960) and nonverbal reinforcers (e.g., Brackbill & O'Hara, 1958; Stevenson, Weir & Zigler, 1959) have demonstrated that this combination also produces performance that is superior to that of Reward-blank. Further, the verbal reinforcement studies have shown that subjects tested under the Reward-Punishment condition tend not to differ in performance from those tested under Punishment-blank (e.g., Curry, 1960). Only a single study employing nonverbal reinforcers made a

similar comparison of the effects of these two conditions on children's performance; in this investigation (Penney & Lupton, 1961), Reward-Punishment was found to be inferior to Punishment-blank.

It has generally been agreed that the superiority of Reward-Punishment and Punishment-blank over Reward-blank indicates that punishment per se is a stronger negative reinforcer than reward is a positive reinforcer. Some investigators have supplemented this interpretation by suggesting further that subjects are more motivated to avoid punishment than to obtain reward and thus, on these tasks, perform better under the Punishment-blank and Reward-Punishment conditions.

Although an explanation in motivational terms may be appropriate for the results of studies of nonverbal reinforcers, more recent evidence suggests that it may be quite inappropriate in accounting for differences between conditions in studies employing the verbal reinforcers "Right" and "Wrong". What has been frequently overlooked in reviews of these studies is that the investigations employing the two types of reinforcers have been conducted under different instructional conditions. In both, the nature of the task has been explained to the subjects in preliminary instructions, but in the set of investigations using verbal reinforcers, no explanation has been given of the reinforcement procedures. Verbal reinforcement studies conducted by the writer

(Spence, Lair, & Goodstein, 1963; Spence, 1964) using adult subjects tested on a 2-alternative discrimination task have demonstrated by means of probability analyses that the inferiority of the Reward-blank condition is due not to "Right" being a less potent reinforcer than "Wrong" but to the inability of many subjects in this condition to interpret accurately the information being conveyed by the experimenter's failure to respond (i.e., blank). Further, when subjects had initially been instructed about the information available from the experimenter's response or failure to respond, it was found that the performance of Reward-blank groups did not differ from that of Punishment-blank and Reward-Punishment subjects, thus yielding different empirical results than those found in investigations employing nonverbal reinforcers but the same type of informative instructions.

The disappearance of the inferiority of the Reward-blank condition when subjects are informed about the information value of the reinforcers does not seem to be limited to adults since a similar study using both normal school children and educable, mentally retarded children also revealed no differences between the Reward-blank and Punishment-blank groups (Spence, 1966).

While the studies just described have compared the effects of punishment with those of reward or of a combination of the two, other studies of response-contingent

reinforcers have compared the effects of different types of reward on performance. Several investigations employing conceptual tasks found that lower-class children performed significantly better when reinforced for correct responses by a material incentive (e.g., candy) than when reinforced by a neutral stimulus (e.g., a light signal); middle-class children, in contrast, performed better under the neutral condition (Terrell, Durkin, and Wiesley, 1959; Cameron and Storm, 1965).

In light of these latter results, it becomes important to inquire about the socio-economic status of the children employed in the studies comparing reward and punishments reviewed above. The investigations of verbal rewards and punishments in which S's were informed about the reinforcers have used adults and school aged children of varying socio-economic backgrounds with no indication of an interaction between type of reinforcer and social class, i.e., all socio-economic groups performed equally well under verbal reward, punishment, and reward-punishment combinations. In the non-verbal studies, in which a material reward has been found to produce poorer performance than punishment or a reward-punishment combination, it appears that only middle-class groups were used. Whether similar results would be found with lower-class groups is thus unknown. Also unknown is the relative efficiency of verbal vs. nonverbal rewards and punishments in either socio-economic group. Several studies of

probability learning (e.g., Stevenson & Hoving, 1963) also suggest that the interaction of these variables with S's age may also be important to consider.

III. Procedure

(a) Subjects

The 576 children who served as subjects (Ss) came equally from middle- and lower-class backgrounds and within each socio-economic level, from three different age levels: 4-5 years (preschool), 7-8 years (2nd and 3rd grades) and 10-11 years (5th and 6th grades). These three age groups will subsequently be referred to as the Preschool, Younger and Older school groups, respectively. The children were drawn from various sources, as described below.

1. Preschool groups (4-5 years). The preschool Ss were obtained from private and church-sponsored preschools in Austin, Texas, each serving children from either predominantly lower-class or middle-class homes.

2. Younger school groups (7-8 years). The Ss at this age level were students of the specified age enrolled in 2nd and 3rd grade classes of two elementary schools, one serving a middle-class neighborhood and the other a lower-class neighborhood.

3. Older school groups (10-11 years). The middle-class Ss were drawn from 5th and 6th grade classes of an elementary school serving a middle-class neighborhood. The lower-class Ss were selected from children meeting the age and grade criteria who were attending a summer day camp sponsored by a private charitable organization for children from impoverished homes.

The ethnic composition of the lower- and middle-class groups differed, the lower-class children being predominantly of Negro or Latin American descent and the middle-class predominantly Anglo-Saxon. The socio-economic status of each S was determined by the occupational level of the head of the household in which the child resided, occupational level being rated by means of Warner's Index of Status Characteristics (Warner, Meeker, & Eells, 1949). Middle-class status in the present investigation was defined as Occupational Class 4 or above and lower-class status as Class 6 or below.

Within each group of the same age and socio-economic level, Ss were assigned to one of the 6 treatment conditions, each of these subgroups containing 8 boys and 8 girls and equated with the others for mean chronological age and, in the case of the two older groups, for grade placement. At each age level, middle-class and lower-class groups were also equated for mean age.

(b) Experimental task and apparatus

All Ss were given a discrimination task consisting of a list of pairs of line drawings depicting familiar but unrelated objects (e.g., a table and a horse), each pair being mounted on a plain 5 in. X 8 in. index card. The length of the list differed for the three age groups, consisting of 6 pairs for the Preschool groups, 8 pairs for the Younger school groups, and 12 pairs for the Older school groups. For each list, one member of each pair was designated

as "correct", the Ss' task being to identify and recall this picture so he could select it each time the pair was presented. The list of pairs was presented in four different serial orders, the right-left position of the members of each pair being counterbalanced across orders. Cards with two practice pairs were also employed, as well as cards for pretest purposes, each of the latter containing one of the pictures to be presented on the practice and experimental lists. The objects depicted in each of the experimental lists and the practice list are shown in Appendix A.

The apparatus consisted of a plywood screen, painted a flat gray, 24 in. high and 18 in. wide with a 4 x 6 in. window at its center in which the stimulus cards were exposed. A piece of polyethylene tubing through which E dispensed the candy reinforcers (plain M&M's) extended to an opening in front of the screen 2 inches below the window, and each piece of candy fell into a transparent dish directly in front of S. The tubing was mounted in back of the screen, as was a shelf, placed below the window to hold the cards, and a manually controlled 2-coil, 6-volt buzzer.

(c) Treatment groups

The 6 treatment groups formed a 3 x 2 factorial design: three reinforcement combinations (Reward-blank, Punishment-blank, and Reward-Punishment) and two types of reinforcers (Verbal and Nonverbal). In the Verbal conditions, the experimenter (E) said "Right" after each correct choice

and remained silent after each incorrect choice, said "Wrong" after each incorrect choice and remained silent after each correct one, or overtly reinforced each choice. The verbal reinforcers were spoken in a firm but affectively neutral tone of voice. In the Nonverbal conditions, E dispensed a piece of candy after each correct choice, sounded the buzzer for 1 sec. after each incorrect choice, or overtly reinforced S after each choice by candy or the buzzer. The Ss in the Candy-blank and Candy-Sound conditions were asked to leave the candy they had earned on the desk in front of them until the end of the experiment, at which time it would be theirs to keep.

(d) Procedure

The children were tested individually in a room located in the institution in which they were enrolled. Each S was first shown the individual pictures one at a time and asked to identify them. All Ss were able to do so satisfactorily.

Instructions were then given about the experimental task. The instructions specified that S was to learn to choose the "right" picture of each pair each time the pair was presented, and contained a full explanation of the reinforcement procedures to be used with a given S. This explanation included explicit statements not only about the information to be obtained about response correctness and incorrectness from the overt reinforcers, but also, in Reward-blank and Punishment-

blank groups, from the failure of an overt reinforcer to appear. The Ss were then given a practice list, with the meaning of each overt reinforcer or failure of an overt reinforcer to occur being pointed out. A test trial was then given, with a third trial being given to Ss who had not chosen correctly on both pairs.

The discrimination list was then presented 16 times, the first being a guessing trial. The S's initial choice for half of the pairs was designated as the "correct" response on this and all subsequent trials and for the other half of the pairs, his initial choice was designated as the "incorrect" response. Each picture containing a pair was presented for 4 sec., with the overt reinforcer (if any) being delivered at the end of this interval. The S was required to make a choice (by pointing and naming) each time a pair was presented. There were 4 sec. between trials, the intertrial interval being indicated by presentation of a card with asterisks at its center.

Following the learning trials, the Candy-blank and the Candy-Sound Ss were given the candy they had earned while Ss in all other groups were also given a bag of candy for their cooperation.

IV. Results

Since the length of the experimental lists differed according to Ss' age level, the data from the three age groups were not directly comparable statistically. The data were therefore treated separately as three replicated experiments, differing only in age of the Ss and length of the list.

In all three experiments, inspection of the learning curves indicated that the pattern of performance formed by the various groups was consistent over trials. The data chosen for statistical analysis were therefore the total number of correct responses over the 15 learning trials for each S. The mean number of correct responses per S for each of the treatment groups at each socio-economic level are shown in Tables 1, 2, and 3 for the Preschool, Younger, and Older school groups respectively, while the results of a 2 x 3 x 2 analysis of variance of each of these sets of data are summarized in Table 4. These analyses did not include the sex of the S as a variable since inspection of the data indicated that in all three age groups, the performance of the boys and girls in each subgroup was quite similar. These tables will be found in Appendix B.

In describing the results obtained from each age group, it will be convenient to discuss the performance of the Younger school groups first, and then the Older and Preschool groups, in that order.

(a) Younger school groups (7-8 years)

As may be seen in Table 2 of Appendix B, the performance of the lower-class Ss was somewhat poorer than that of the middle-class Ss but within each socio-economic level, the pattern of performance of the 6 treatment groups was quite similar. That is, in confirmation of previous studies using informative instructions (e.g., Spence, 1966) there were only minor differences among the three verbal reinforcement combinations within each socio-economic level. Also in confirmation of previous studies employing middle-class children (e.g., Brackbill & O'Hara, 1958), both the middle-class and the lower-class groups of the present study performed markedly poorer under the Candy-blank combination than under the Sound-blank or the Candy-Sound combination. Finally, it will be noted that while the Sound-blank and Candy-Sound groups were similar to each other and to the parallel verbal groups, Candy-blank was inferior to Right-blank. In essence, then, 5 of the 6 treatment conditions produced essentially the same performance, with Candy-blank being deviantly low.

The analysis of variance of these data, summarized in Table 4, revealed that the main effects of socio-economic level, reinforcement type, and reinforcement combination were all statistically significant (p's $< .05$), as was the interaction between reinforcement type and combination. With the exception of the main effect of Ss' class, all of these significant terms were due primarily to the inferiority of the Candy-blank groups.

(b) Older school groups (9-10 years)

Observation of the Older school children in the experimental situation suggested that many of them, unlike the two younger age groups, were rather bored and disinterested in the entire procedure, a phenomenon which may be age-related since the childrens' teachers reported similar classroom behavior. These attitudinal factors may have been responsible for the high level of variability among the Ss in performance which may be seen by examining the standard deviations reported in Table 3, as well as a rather erratic pattern of means, particularly in the Verbal conditions. However, when the lower-class and middle-class groups (who did not differ significantly in over-all performance) are combined, a pattern emerges with respect to treatment conditions that is quite comparable to that found with the younger elementary school children reported above. That is, as with these latter Ss, the Candy-blank condition produced the poorest performance of the 6 treatment conditions. Secondly, with the exception of the deviantly high performance of the Wrong-blank Ss (which was most probably due to sampling error since there are neither empirical nor theoretical grounds for expecting this superiority), the performance levels of the remaining treatment groups were all quite similar to each other. In the analysis of variance of these data, the main effect of reinforcement type and the type x combination interaction were both significant.

(c) Preschool groups (4-5 years)

The means of the various Preschool groups are shown in Table 1 and the analysis of variance of these data in Table 4. This analysis revealed not only that the main effect of Ss' socio-economic class was significant, the lower-class groups being poorer, but that the class x type and class x combination interactions were also significant. Since they did not show the same pattern of responses to the treatment conditions, the data from the lower-class and middle-class preschool Ss can most conveniently be discussed by being described separately.

In the lower-class groups, the order of performance produced by the three reinforcement combinations was the same in the Verbal and Nonverbal conditions, Reward-blank being poorest and Reward-Punishment the best. The inferiority of the Candy-blank combination to the other Nonverbal combinations thus confirmed the results of prior studies, including those obtained with the Younger and Older school groups of the present study. However, the inferiority of the Right-blank Ss to the other Verbal groups is quite contrary to what has been found both in the school age groups of the present study and in previous investigations in which Ss were also given preliminary instructions about the information value of the reinforcing events.

Inspection of the performance data of individual Ss indicated, however, that the Candy-blank and the Right-blank

inferiority of these preschool lower-class Ss did not come about in the same manner. In order to explain this statement, it is necessary first to review the results of verbal reinforcement combination studies in which Ss were not instructed about the reinforcing events. Under these instructional conditions, Right-blank has quite uniformly been found to produce poorer performance than Wrong-blank or Right-Wrong. Studies by the present investigator in which post-experimental interviews were given suggest that this result is due to the presence of Ss in the Right-blank condition who assume that blank as well as "Right" indicated that they had responded correctly (and were therefore never wrong). Apparently this assumption leads S to interpret the discrimination learning task as being one in which he is expected to learn to repeat all of his previous choices since these Ss uniformly exhibit a perfect or near perfect pattern of repetition of both correct and incorrect responses. (The presence of this repetition pattern in Right-blank Ss who incorrectly state the information value of blank in a post-experimental interview and the absence of this pattern in all other Ss make the presence of the pattern an alternative method for identifying Ss who misinterpret blank). As was also discussed above, in the studies in which the reinforcers have been explained, no "repeaters" have been found and the over-all inferiority of the Right-blank group has disappeared. These latter studies, it should be noted, have employed Ss of elementary school age

or older. Returning to the preschool lower-class children of the present investigation, the records of these Ss were examined for the presence of this pattern of repeating all previous responses. In order to have an objective criterion by which Ss could be classified as "repeaters" or "non-repeaters," the number of trials on which the incorrect responses of each successive trial were perfectly repeated on the subsequent trial was counted for each S. A bimodal distribution was found in the Right-blank group. Five of the 16 Ss showed perfect repetition of incorrect responses on only four or fewer of the 15 trials, while 11 Ss repeated perfectly on 13 or more trials and were designated as "repeaters". While over two-thirds of the Right-blank Ss exhibited the repetition pattern, only one S in the Candy-blank group, and one S in each of the other treatment groups except Wrong-blank, repeated perfectly on 13 or more trials, the remaining Ss doing so on five trials or less. (It might also be noted at this point that no "repeaters" were found in any of the treatment conditions for the two groups of school age children whose data were reported above).

These results thus suggest that the preschool lower-class Ss were less able than older Ss to understand or to apply the preliminary instructions concerning the reinforcing events (particularly blank) to their performance, with the result that many of the Ss in the Right-blank condition acted in the same manner as uninformed groups--i.e., they treated

blank as though it meant "Right" and adopted the approach of repeating all previous choices. The inferior performance of the preschool Ss in the Candy-blank condition, on the other hand, did not appear to arise because of the same kind of informational factor.

Finally, attention will be called to one other aspect of the performance of the lower-class children of preschool age. In both the Verbal and Nonverbal conditions, the Reward-Punishment combination produced markedly superior performance to that of the other two combinations, both of which involved blank. This Reward-Punishment superiority, which was not found in the middle-class Ss of the same age and is primarily responsible for the significant class x combination interaction reported in Table 4, probably also reflected the inability of these lower-class Ss to cope with blank as adequately as an overt reinforcer, even though they did not necessarily misinterpret its information value.

Turning now to the middle-class children, the Ss in the Right-blank condition were also inferior to Ss in the Wrong-blank and Right-Wrong groups but to a lesser degree than was found in the lower-class children. This slight inferiority may also be attributed to the presence of several "repeaters" in this condition, 3 of the 16 Right-blank Ss exhibiting this pattern of performance. When the records of these Ss were eliminated, the mean performance of the remaining Ss was found to be comparable to that of the other verbal groups.

The Candy-blank condition was again inferior to the other nonverbal combinations and in fact, these Ss were the poorest of the 6 treatment groups, just as had been found with the two school age groups. Unlike any of the other groups, however, these preschool middle-class Ss did not perform as well under any of the nonverbal conditions as in the parallel verbal condition. (This phenomenon is responsible for the significant class x type of reinforcer interaction found in the analysis of variance of the preschool groups reported in Table 4.) It is not clear whether this performance discrepancy between verbal and nonverbal conditions was due to sampling error or to factors uniquely associated with children of this particular age and socio-economic level.

V. Conclusions

A good many studies have been conducted to determine the relative effectivness of different reinforcement conditions on performance or to determine the interaction between reinforcement condition and subject characteristics. In discussing the results of such studies, investigators have typically suggested rather simple empirical generalizations which have broad implications with respect to the variety of situations to which they apply, or have given theoretical explanations which attribute to reinforcers a single, uniform set of properties, most usually motivational in nature. For example, in studies employing the same type of response-contingent design as the present investigation, the inferiority of a condition in which Ss are rewarded by material incentives, in comparison to a punishment or a reward-punishment condition, has typically been interpreted as indicating that children are more motivated to avoid punishment than to obtain reward and hence perform better under conditions that involve punishment. Similarly, investigators comparing the performance of lower- and middle-class children have reached the broad conclusion that, due to motivational factors, lower-class children perform better with material rewards than with symbolic ones while for middle-class children the converse is true.

As data accumulate, however, it is becoming evident that no broad generalizations about the effects of reinforcers are

possible, reinforcers interacting not only with subject variables but with characteristics of the task, instructions, and other situational variables to determine performance. Further, reinforcers appear to have a number of properties in addition to motivational ones, these properties varying from one situation to another. The results of the present investigation, in conjunction with those of previous studies of similar design, demonstrate these complexites.

In the two school age groups, it will be recalled, the Candy-blank condition produced poorer performance than any of the other treatment conditions, including Right-blank. In order to maintain the motivational interpretation given to prior studies employing only nonverbal combinations, the interpretation that children are less motivated by reward than by punishment, one would first have to restrict this generalization to nonverbal reinforcers since Right-blank did not produce a similar inferiority. Secondly, even within these limits, one would also have to maintain that material rewards are less motivating than symbolic ones (i.e., Candy less motivating than "Right"), not only in middle-class but also in lower-class children. A more plausible explanation, especially in light of further evidence to be reviewed below, is that the Candy-blank inferiority represents some type of distractibility phenomenon, the child's attention to the task being diverted by the mechanics of earning and receiving the reward. Unpublished data of the present investigator further suggest

that the inferiority of a material reward condition may be confined to the particular response contingent design of these studies; when candy followed correct responses but was used to supplement neutral information (showing S the correct stimulus after each choice), its introduction did not result in performance detriment in comparison to Ss given only neutral information or other kinds of supplementary reinforcers.

The results obtained with the preschool children appear to demonstrate even more directly the operation of other than motivational factors. In the absence of instructions about its meaning, Ss tend to treat blank as though it indicated "Right", a tendency which interferes with performance in the case of Ss in a Right-blank condition. A majority of the lower-class preschool children in the Right-blank condition of present study exhibited this same tendency, despite the f[illegible] that they had been instructed about the information value [illegible]blank. These children also had more difficulties in utilizing blank in any of the conditions, the two Reward-Punishment conditions producing the best performance. These difficulties in utilizing blank were less marked or absent in the middle-class preschoolers, which may be due to their greater experience in dealing with verbal abstractions in general or more specifically, in game-like situations with arbitrarily designated "right" and "wrong" responses and other similar rules.

The large number of lower-class preschool children

in the Right-blank condition who appeared to misinterpret blank and adopted the procedure of repeating all previous responses brought the performance level of these Ss down to that of the Candy-blank Ss. In all other groups, however, Right-blank produced better performance than Candy-blank, as was noted above. The superiority of the symbolic reward condition (Right-blank) over the material incentive condition thus replicates the results found in several previous studies of conceptual learning (e.g., Cameron & Storm, 1965) with middle-class children. In these same studies, however, lower-class children were also tested and found to exhibit the opposite results, i.e., their performance was better with a material incentive. Thus the data from the lower-class school children of the present study directly contradict previous findings. A recently completed study (Veatch, 1966), a thesis performed under the direction of the present writer, suggests that type of task may be the relevant empirical variable determining the nature of the interaction between Ss' class and type of reward. In lower-class children, material reward continued to produce poorer performance than a symbolic one when the rote learning, discrimination task employed in the present investigation was used, but this inferiority disappeared when a conceptual task of the type used by previous investigators was employed. Just why a conceptual task should produce such completely opposite results to a discrimination task, and why this task effect should be confined to lower-class

children is not immediately apparent. However, the empirical fact remains: the nature of the effect of type of reward in lower-class Ss depends on type of task.

To reiterate what was said earlier, reinforcers play a variety of roles and interact with a host of situational factors and subject characteristics to determine performance. In view of the importance of reinforcement procedures in educational practice, particularly in such recently developed techniques as programmed instruction, operant conditioning, etc., it would appear to be essential to identify these factors and to develop a more adequate theoretical analysis of reinforcers so that the most effective performance conditions for a given child in a given situation can be specified.

VI. Summary

Children of three different age levels (4-5, 7-8, or 10-11 years) and within each of these, from lower-class or middle-class homes, were given a 2-alternative discrimination task to learn under various reinforcement conditions. These conditions, which employed response-contingent reinforcers which were Ss' only source of information about response correctness or incorrectness, formed a 3 x 2 factorial design: 3 reinforcement combinations (reward for correct responses, punishment for incorrect responses, or both reward and punishment) and 2 types of reinforcers (Verbal, the words "Right" and "Wrong"; and Nonverbal, candy and a raucous buzzer). The younger school age children of both socio-economic groups performed significantly worse under the candy-reward condition (including the parallel verbal reward condition) and approximately the same under the 5 remaining conditions. The older school children exhibited essentially the same pattern.

Several differences were found between these groups and the preschool children, particularly those from a lower-class background. A majority of the lower-class children in the verbal reward condition apparently misinterpreted E's failure to respond as also indicating "Right", despite the fact that its information value had been explained, and adopted a procedure of repeating all previous responses, correct and incorrect. They thus behaved in the same manner as has been

found in previous studies in which subjects were given no explanation of the reinforcement procedures. The lower-class preschool groups also seemed, in general, less able to utilize the information available from the failure of an overt reinforcer to occur so that contrary to what was found in the older groups, they performed best under reward-punishment conditions in which every response was overtly reinforced. In the middle-class preschool groups, these difficulties occured to a lesser degree if at all. Unlike any of the other groups, however, these Ss performed better under each of the verbal conditions than under the parallel nonverbal condition.

The complex roles played by reinforcement conditions, as demonstrated by these findings and those from prior investigations of similar design, were discussed.

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Appendix A

Names of Pairs of Objects Depicted on the Practice and Experimental Discrimination Lists

Practice List (all Ss)	Experimental List*
1. Cake-Tree	1. Fish-Chair
2. Horse-Gun	2. Shoe-Apple
	3. Bed-Car
	4. Dog-Boat
	5. Spoon-Boy
	6. Flower-Cup
	7. Pie-Bird
	8. House-Book
	9. Lamp-Pipe
	10. Bat-Wagon
	11. Saw-Phone
	12. Table-Shirt

*The list for the Preschool group was made up of the first 6 pairs, the list for the Younger school group of the first 8 pairs, and for the Older school group, all 12 pairs.

Appendix B

Table 1

Preschool Groups

Means of Total Number of Correct Responses for the Six Treatment Groups at Each Socio-economic Level

Reinforcement Combination	Middle-class				Lower-class			
	Verbal		Nonverbal		Verbal		Nonverbal	
	M	SD	M	SD	M	SD	M	SD
Reward-blank	61.94	19.76	53.19	9.09	47.81	8.00	50.06	10.18
Punishment-blank	71.75	16.18	64.37	15.30	58.63	15.91	60.00	15.65
Reward-Punishment	70.56	13.30	61.63	15.80	70.31	16.28	67.56	15.54

Table 2

Younger School Groups

Means of Total Number of Correct Responses for the Six Treatment Groups at Each Socio-economic Level

	Middle-class				Lower-class			
Reinforcement	Verbal		Nonverbal		Verbal		Nonverbal	
Combination	M	SD	M	SD	M	SD	M	SD
Reward-<u>blank</u>	96.56	16.60	73.38	11.89	88.94	22.51	73.31	16.09
Punishment-<u>blank</u>	92.62	22.58	98.69	21.21	87.81	22.40	90.38	19.86
Reward-Punishment	99.69	16.70	98.62	21.62	91.50	15.24	85.00	22.50

Table 3

Older School Groups

Means of Total Number of Correct Responses for the Six Treatment Groups at Each Socio-economic Level

Reinforcement Combination	Middle-class				Lower-class			
	Verbal		Nonverbal		Verbal		Nonverbal	
	M	SD	M	SD	M	SD	M	SD
Reward-blank	124.56	26.42	117.88	25.32	140.31	24.63	123.94	23.19
Punishment-blank	156.19	11.34	140.62	21.20	162.62	16.27	148.12	11.98
Reward-Punishment	144.88	13.79	137.75	21.51	126.62	29.89	144.44	32.63

Table 4

Summary of Analyses of Variance of Data from the Three Age Groups

		Preschool		Younger School		Older School	
Source	df	MS	F	MS	F	MS	F
Soc.-Ec. Class	1	1126.17	4.93*	2422.52	6.43*	780.00	1.44
Reinf. Type	1	780.04	3.42	1900.09	5.04*	2401.20	4.44*
Reinf. Combination	2	3489.11	15.29**	2158.22	5.73**	101.92	< 1
Class x Combination	2	709.23	3.11*	203.04	< 1	687.98	1.27
Class x Type	1	897.01	3.93*	2.52	< 1	354.80	< 1
Type x Combination	2	39.67	< 1	2325.94	6.17**	11988.18	22.18**
Class x Type x Comb.	2	23.19	< 1	196.76	< 1	1785.82	3.31*

* $p < .05$

** $p < .01$